

CHEMTECH INDEX 1977

January 1-64

February 65-136

March 137-200

April 201-264

May 265-328

June 329-392

July 393-456

August 457-520

September 521-584

October 585-648

November 649-712

December 713-784

AESTHETICS, ETHICS, AND METAPHYSICS

A not-so-spare spare editorial	65
Literature in the age of technology	16
How to choose a theory	10
Utopia or hell—it's our choice	336
Courtiers and artisans	553
Dialogue	459
Computer power and human reason	593
To a summer past	585
The toy theory of western history	595
Is chemistry just underdeveloped physics?	659
Me teach human values?	725
SCIENCEANDTECHNOLOGY—II	521

AGRICULTURE

Cattle and chemistry	290
Fungicides—past, present, and future	302
The sunny side of the future	352
Man against weeds	374
Food demand factors	414
Fermentation industries . . . quo vadis?	434
How to DROP the tomato	472
Leaves of autumn	525
It's in the bag	559
Pitfalls in analysis—pesticide residues	576
Combustible renewable resources	611
Gasoline does, too, mix with alcohol	616
On rubber plants	693
Flavor chemistry—coffee, cocoa, and tea	664

ANALYSIS AND TESTING

Chromatographic anomalies	101
Carcinogens in the environment	76
Durability testing	184
Measure particle size by hydrodynamic chromatography	196
Revenooers in lab coats	146
Thermogravimetry	381
Pitfalls in analysis—pesticide residues	576
The last DU	Sept. IBC
Immobilized enzymes for chemical analysis	642
Weisburger	000
Reclamation via reverse osmosis	696
Look what's become of chemical analysis	687
Guesstimate the behavior of binaries	700
The common cold and vitamin C	728

BIOLOGY

Traditional fermentation in modern dress	94
Designing biologically active materials	120
Cattle and chemistry	290
Recombinant DNA research	205
Antioxidants vs. aging	276
Smooth, flexible biomaterials	240
Man against weeds	374
Modern anesthetics	446
Fermentation industries . . . quo vadis?	434
Leaves of autumn	525
Specs for a safe "high"	530
The chemistry of contraceptives	563
Immobilized enzymes for chemicals analysis	642
The common cold and vitamin C	728
Flavor chemistry—coffee, cocoa, and tea	664
Cancer prevention	734

BUSINESS

Effects of inflation on capital investments	129
Constraints to innovation	23
Today's managers are pussycats	144
Whatsoever man can conceive . . .	156
Age vs. efficiency	153
Goat hunting—the new national pastime	139
Sue who?	159
The patent filing decision	225
How to increase R&D budgets	222
What business are we in, anyway?	347
Striking a new balance	394
Drug and alcohol abuse—a company view	412
The innovator	400
The changing environment for industrial R&D	539
Why project costs "always" go up	551
Trading technology	601

CATALYSIS

Why not do it in one step?	36
Catalysis with soluble bimetallic oxides	192
When you know you need a catalyst, it's later than you think	228
Characterized catalysts via temperature-programmed reduction	316

Acrylamide production simplified	306
Hybrid-phase catalysts	512
Catalysis—on top of semiconductors	570

CHEMICAL SCIENCE

Can alkyl boranes tell right from left?	114
Cross-linked polymers based on pivalolactone and diisocyanates	108
A personal retrospective on boron hydride chemistry	50
Why not do it in one step?	36
How to choose a theory	10
Designing biologically active materials	120
Measure particle size by hydrodynamic chromatography	196
Catalysis with soluble bimetallic oxides	192
Solvent concepts	255
What's so sacred about 14.7 psi?	248
Look again at matter	464
Use THE SECOND LAW, first	496
Hybrid-phase catalysts	512
Catalysis—on top of semiconductors	570
Specs for a safe "high"	530
Synthetic housekeeping—nitration	626
Is chemistry just underdeveloped physics?	659
Cyclization via pyrolysis	690
Non-aqueous solvents of cellulose	702
Guesstimate the behavior of binaries	700
Tailoring surfaces with silanes	766
Crosslink ionically	748
How it's really done—I	754

DATA CORRELATION

How do we decide?	72
Beware of nonindependent observations!	117
Effects of inflation on capital investments	129
Chromatographic anomalies	101
Planning can save time but can be overdone	84
Designing biological active materials	120
Responsibilities of the community to its chemists	Feb. OBC
Solve problems via factor analysis	321
Pitfalls in analysis—pesticide residues	576
Estimating sources of variability	580
Must I randomize?	630
Is chemistry just underdeveloped physics?	659

ECONOMICS

Effects of inflation on capital investments	129
Planning can save time but can be overdone	84
Employment contracts	7
A bigger strategy for business in '77	2
Penny-wise	1
Getting projects up and running in the Middle East	28
Whatsoever man can conceive . . .	156
Goat hunting—the new national pastime	139
Energy policy: a dimstore approach	208
How to increase R&D budgets	222
Refuse: resource or liability	207
Petrochemicals from coal	295
The <i>modern</i> little red hen	June IBC
Food demand factors	414
Alternate fuels from coal	418
Technology and the good life	456
The changing environment for industrial R&D	539
Big science—from whence and whither	541
Why project costs "always" go up	551
Courtiers and artisans	553
It's in the bag	559
Infratechnology	591
Trading technology	601
Let's be sensible about risks and benefits	717

EDUCATION

A younger chemist's view of the future	69
Professings of a professor	90
The decision to hire	70
How to choose a theory	10
Age vs. efficiency	153
An ivory tower chemist dines in the real world	272
Dialogue	459
An MS by TV	468
SCIENCEANDTECHNOLOGY—II	521
Big science—from whence and whither	541
Chemistry and law: one world	598
Is chemistry just underdeveloped physics? "Researchmanship", or how to get your PhD without actually working	783
Chemistry as a foreign language	747
How it's really done—I	754
Me? Teach human values?	725

ENERGY AND FUELS

Stimulating energy technology	32
Whatsoever man can conceive . . .	156
From garbage—OIL	164
Tertiary oil recovery and chemistry	232
Our solar house	210
Energy policy: a dimstore approach	208
Refuse: resource or liability	207
Let the dinosaur die	282
Petrochemicals from coal	295
On nuclear moratoria	330
The sunny side of the future	352
About coke—and where the sulfur went	366
Alternate fuels from coal	418
Nuclear power and public policy	484
Use THE SECOND LAW, first	496
Plastics from plastics	507
Courtiers and artisans	553
To a summer past	585
Will Cinderella beat the clock?	606
Combustible renewable resources	611
Gasoline does, too, mix with alcohol	616
On rubber plants	693
Oil, Saudi development, and world stability	651
Asphalts—keys to coal liquefaction	680
Research in reverse	753

Enhanced oil recovery challenges chemists	
How it's really done—I	

ENGINEERING

Prostheses made of carbon	40
Why not do it in one step?	36
Effects of inflation on capital investments	129
Technology vs. disease	174
When you know you need a catalyst, it's later than you think	228
What's so sacred about 14.7 psi?	248
An ivory tower chemist dines in the real world	272
The sunny side of the future	352
About coke—and where the sulfur went	366
The little engine that would	403
Alternate fuels from coal	418
Agglomeration—why and how	424
Unit operations concepts optimize operations	428
Dialogue	459
How to DROP the tomato	472
Plastics from plastics	507
The Cold Model concept	556
Trading technology	601
The toy theory of western history	595
Tailoring surfaces with silanes	766
Enhanced oil recovery challenges chemists	762
Chemistry as a foreign language	747

ENVIRONMENT

Constraints to innovation	23
Carcinogens in the environment	76
Revenooers in lab coats	146
From garbage—OIL	164
Tertiary oil recovery and chemistry	232
Refuse: resource or liability	207
The sunny side of the future	352
Plastics from plastics	507
Leaves of autumn	525
To a summer past	585
Combustible renewable resources	611
Look what's become of chemical analysis	687

FOOD

Carcinogens in the environment	76
Traditional fermentation in modern dress	94
Sweetness—a supernormal reinforcer	214
Cattle and chemistry	290
Man against weeds	374
Crispness—a psychoacoustical theory	340
Food demand factors	414
Unit operations concepts optimize operations	428
It's in the bag	559
The common cold and vitamin C	728
Flavor chemistry—coffee, cocoa, and tea	664
Gasoline does, too, mix with alcohol	616

GOVERNMENT

Stimulating energy technology	32
A bigger strategy for business in '77	2
Age vs. efficiency	153
Revenooers in lab coats	146
The patent filing decision	225
Sweetness—a supernormal reinforcer	214
Energy policy: a dimstore approach	208
Recombinant DNA research	205
Let the dinosaur die	282
Responsive regulation	267
On nuclear moratoria	330
Utopia or hell—it's our choice	336
TSCA—an EPA view	405
Striking a new balance	394

TSCA—a symposium	408
Risk	477
Nuclear power and public policy	484
Why the director was fired	520
Specs for a safe "high"	530
Big science—from whence and whither	541
Courtiers and artisans	553
The last DU	Sept. IBC
Infratechnology	591
Will Cinderella beat the clock	606
Metrication—Cuban style	Oct. IBC
Oil, Saudi development, and world stability	651

HISTORY

Responsibilities of the community to its chemists	Feb. OBC
Literature in the age of technology	16
A personal retrospective on boron hydride chemistry	50
How to choose a theory	10
Fungicides—past, present, and future	302
Farrington Daniels, Jr. on Farrington Daniels	May OBC
Food demand factors	414
Fermentation industries . . . quo vadis?	434
The chemistry of contraceptives	563
The last DU	Sept. IBC
The toy theory of western history	595

INFORMATION AND COMMUNICATION

How do we decide?	72
Responsibilities of the community to its chemists	Feb. OBC
Literature in the age of technology	16
The annual sales pitch	137
Alice in attill land	April OBC
An MS by TV	468
How to sell your project	402
My idea, our implementation	537
Research planning European style	547
Metrication—Cuban style	Oct. IBC
Keep professionals home!	657
Epitaph for Jimmy	Nov. IBC
Research in reverse	753
How you come across, why and what to do about it	720

INNOVATION AND INVENTION

Constraints and innovation	23
Stimulating energy technology	32
How to choose a theory	10
Technology vs. disease	174
Fun and frustration with foams	170
Our solar house	210
What business are we in, anyway?	347
Utopia or hell—it's our choice	336
Striking a new balance	394
The innovatoneer	400
The little engine that would	403
How to sell your project	402
TSCA—an EPA view	405
TSCA—a symposium	408
Unit operations concepts optimize operations	428
Technology and the good life	456
How to DROP the tomato	472
Risk	477
Specs for a safe "high"	530
My idea, our implementation	537
The changing environment of industrial R&D	539
Research planning European style	547
The Cold Model concept	556
Chemistry and law: one world	598
Will Cinderella beat the clock?	606
Metrication—Cuban style	Oct. IBC
Is chemistry just underdeveloped physics?	659

MANAGEMENT, ORGANIZATION

Professings of a professor	
Planning can save time but can be overdone	
Getting projects up and running in the Middle East	
Stimulating energy technology	
Today's managers are pussycats	
View from the inside	
How to increase R&D budgets	
On product vs. process	
Unit operations concepts optimize operations	
A nickel for your R&D	
Trade secrets—ethics and law	

MANAGEMENT, PEOPLE

A younger chemist's view of the future	69
Professings of a professor	90
The decision to hire	70
Lucky Alva	Mar. OBC
Penny-wise	1
Getting projects up and running in the Middle East	28
Employment contracts	7
Today's managers are pussycats	144
Sue who?	159
On product vs. process	201
Image	329
The chicken coop	393
How to sell your project	402
A nickel for your R&D	461
Why the director was fired	520
My idea, our implementation	537
Research planning European style	547
Participative R&D	548
Luberman	000
Keep professionals home!	657
How you come across, why and what to do about it	720

MANUFACTURING

Protheses made of carbon	40
Why not do it in one step?	36
Whatsoever man can conceive . . .	156
Goat hunting—the new national pastime	139
From garbage—OIL	164
The patent filing decision	225
Our solar house	210
Agglomeration—why and how	424
Fermentation industries . . . quo vadis?	434
Gasoline does, too, mix with alcohol	616
Flavor chemistry—coffee, cocoa, and tea	664

MARKETING

The patent filing decision	225
How to sell your project	402
The little engine that would	403
Participative R&D	548
Why project costs "always" go up	551
It's in the bag	559
Trading technology	601
Will Cinderella beat the clock	606

MATERIALS

Protheses made of carbon	40
Cross-linked polymers based on pivalolactone and diisocyanates	108
Fun and Frustration with foams	170
From garbage—OIL	164
Tangled polymers	188
Tertiary oil recovery and chemistry	232
Smooth, flexible biomaterials	240

Refuse: resource or liability	207
Acrylamide production simplified	306
About coke—and where the sulfur went	366
The sunny side of the future	352
Alternate fuels from coal	418
Agglomeration—why and how	424
Fermentation industries . . . quo vadis?	32
Look again at matter	144
Plastics from plastics	217
Catalysis—on top of semiconductors	222
The toy theory of western history	201
Elastomers for toughening styrene polymers	634
Asphaltols—keys to coal liquefaction	428
Crosslink ionically	461
Tailoring surfaces with silanes	742

MEDICINE

Protheses made of carbon	40
Carcinogens in the environment	76
Designing biologically active materials	120
Technology vs. disease	174
Smooth, flexible biomaterials	240
Recombinant DNA research	205
Antioxidants vs. aging	276
Drug and alcohol abuse—a company view	412
Modern anesthetics	446
The chemistry of contraceptives	564
Cancer prevention	734
The common cold and vitamin C	728

MICROBIAL

Traditional fermentation in modern dress	94
Recombinant DNA research	205
Fermentation industries . . . quo vadis?	434
Immobilized enzymes for chemical analysis	642

PATENTS

The patent filing decision	
Chemistry and law: one world	
Trading technology	
Trade secrets—ethics and law	

PESTICIDES

Carcinogens in the environment	76
Fungicides—past, present, and future	302
Man against weeds	374
It's in the bag	559
Pitfalls in analysis—pesticide residues	576
Designing biologically active materials	120

PHYSICAL PROPERTIES

Chromatographic anomalies	
Fun and Frustration with foams	
Measure particle size by hydrodynamic chromatography	
Solvent concepts	
Crispness—a psychoacoustical theory	
Thermogravimetry	
Solve problems via factor analysis	
Striking a new balance	
Use THE SECOND LAW, first	
Look again at matter	
Leaves of autumn	
The last DU	
Reclamation via reverse osmosis	
Non-aqueous solvents of cellulose	
Guessimate the behavior of binaries	

PLASTICS AND POLYMERS

Cross-linked polymers based on pivalolactone and diisocyanates	240
---	-----

Fun and Frustration with foams	170
Tangled polymers	188
Smooth, flexible biomaterials	240
Plastics from plastics	507
Hybrid-phase catalysts	512
Elastomers for toughening styrene polymers	634
The sunny side of the future	352
Reclamation via reverse osmosis	696
Crosslink ionically	748
How it's really done—I	754
Thermogravimetry	381
A scale-up experience, The DSM phosphate caprolactam process	309

PROCESSES

A scale-up experience, The DSM phosphate caprolactam process	309
Look again at matter	464
Hybrid-phase catalysts	512
Catalysis—on top of semiconductors	570
Synthetic housekeeping—nitration	626
Immobilized enzymes for chemical analysis	642
Reclamation via reverse osmosis	696
How it's really done—I	754

PROCESS DESIGN

Why not do it in one step?	36
Traditional fermentation in modern dress	94
When you know you need a catalyst, it's later than you think	228
What's so sacred about 14.7 psi?	248
Solvent concepts	255
A scale-up experience, The DSM phosphate caprolactam process	309
Acrylamide production simplified	306
About coke—and where the sulfur went	366
The innovatoneer	400
Alternate fuels from coals	418
Unit operations concepts optimize operations	428
How to DROP the tomato	472
Use THE SECOND LAW, first	496
Hybrid-phase catalysts	512
The Cold Model concept	556
Asphaltols—keys to coal liquefaction	680
Enhanced oil recovery challenges chemists	762

PROFESSIONALISM

A younger chemist's view of the future	69
Professings of a professor	90
The decision to hire	70
Responsibilities of the community to its chemists	Feb. OBC
Lucky Alva	Mar. OBC
Employment contracts	7
Today's managers are pussycats	144
Age vs. efficiency	153
Sue who?	159
The patent filing decision	225
View from the inside	217
On product vs. process	201
By the bayou	265
An ivory tower chemist dines in the real world	272
Image	329
The modern little red hen	June IBC
Drug abuse and alcohol—a company view	412
The alchemy of transforming the competent	457
Dialogue	459
A nickel for your R&D	461
Why the director was fired	520
My idea, our implementation	537
Chemistry and law: one world	598

Keep professionals home!
Trade secrets—ethics and law
How you come across, why and
what to do about it

R&D

Constraints to innovation 23
How to increase R&D budgets 222
The chicken coop 393
Striking a new balance 394
SCIENCEANDTECHNOLOGY—II 521
Big science—from whence and whither 541
Participative R&D 548
Synthetic housekeeping—nitration 626
Research in reverse 753

SAFETY

A not-so-spare spare editorial 65
Goat hunting—the new national pastime 139
Revenooers in lab costs 146
Sue who? 159
Let the dinosaur die 282
Sweetness—a supernormal reinforcer 214
Responsive regulation 267
On nuclear moratoria 330
Utopia or hell—it's our choice 336
Man against weeds 374
Striking a new balance 394

657 TSCA—an EPA view
742 TSCA—a symposium
Drug and alcohol abuse—a company view
720 Risk
Nuclear power and public policy
Specs for a safe "high"
The toy theory of western history
Epitaph for Jimmy
Let's be sensible about risks
and benefits
Cancer prevention

SPECIALTIES

626 Protheses made of carbon
753 Catalysis with soluble bimetallic oxides
Our solar house
Smooth, flexible biomaterials
Petrochemicals from coal
Crispness—a psychoacoustical theory
Reclamation via reverse osmosis
Non-aqueous solvents of cellulose

SYNTHESIS

Traditional fermentation in modern dress
Designing biologically active materials
Tangled polymers
When you know you need a catalyst,
it's later than you think

405 Solvent concepts 255
408 The sunny side of the future 352
412 About coke—and where the sulfur went 366
477 Alternate fuels from coal 418
484 Fermentation industries . . .
530 quo vadis? 434
595 Specs for a safe "high" 530
Nov. IBC Elastomers for toughening styrene polymers 634
Cyclization via pyrolysis 690
717 How it's really done—I 754
734

TRANSPORTATION

1977: Resolutions of a
harried traveler Jan. OBC
192 The little engine that would 403
210 Food demand factors 414
240 Combustible renewable resources 611
295 Keep professionals home! 657

TONGUE-IN-CHEEK

1977: Resolutions of a
harried traveler Jan. OBC
Lucky Alva Mar. OBC
94 Alice in Attitt land April OBC
120 The *modern* little red hen June IBC
188 Technology and the good life 456
"Researchmanship," or how to get your
PhD without actually working 783

AUTHORS

Abend, C. J. 400
Agarwal, N. K. 40
Akhdar, F. 651
Akins, R. J. 40
Akiyama, S. 36
Alder, E. F. 374
Alexander, B. 69
Anderson, N. G. 174
Arkles, B. 766
Arnold, C. W. 762
Asma, F. E. 412

Baruch, J. J. 591
Bateman, J. H. 5, 203,
269, 465, 719
Bauer, H. 164
Bayer, G. 381
Bellow, S. 16
Bloul, J. P. 192
Bokros, J. C. 40
Bossong, K. 676
Bourne, M. C. 340
Bradbury, F. R. 23
Brant, D. 720
Brenner, D. 748
Brody, A. L. 559
Brookman, R. S. 170
Brown, W. C. 606
Bruck, S. D. 240
Burford, C. L. 129
Burg, A. B. 50
Buscemi, P. C. 146

Calvin, M. 352
Cantor, M. B. 214
Carlson, R. A. 472
Cavanaugh, W. T. 72
Chowdhury, S. R. 414
Clark, J. P. 747
Coler, M. April OBC
Commoner, B. 76

Cook, N. 626
Coulehan, J. 728

Daniels, F., Jr. May
OBC
Davis, G. 626
Denkewalter, R. G.
222
Denson, D. 446
de Rooij, A. H. 309
Dijkhuys, C. 309
Doscher, T. M. 232
Drake, W. P. June IBC
Dryden, R. O. 129
Durrell, W. S. 5, 203,
269, 465, 719

Eddinger, R. T. 556
Elchler, R. J. 214
Eisenschiml, O. Feb.
OBC

Farcaslu, M. 680
Farkas, D. F. 428
Finnegan, M. B. 598
Flowers, B. 484
Friedman, M. 2
Frisch, H. L. 188
Frisch, K. C. 188
Fritz, J. J. 207
Fukunaga, J. 120

Gaede, J. 114
Gaggioli, R. A. 496
Galloway, G. L. 725
Gee, E. A. 394
Goodwin, A. E. 468
Gray, D. N. 642
Grubbs, R. H. 512
Gutmann, V. 255

Haensel, V. March
OBC
Hahn, G. J. 117, 580,
630
Hanley, J. W. 717
Hansch, C. 120
Hanson, C. 700
Hass, H. B. 525
Haubold, A. D. 40
Heady, E. O. 414
Heckert, R. E. 539
Hill, G. R. 156
Hocks, L. 192
Hoogerheide, J. C. 94
Horsfall, J. G. 302
Horwitz, B. 459
Hughes, D. 140, 203,
397, 588
Huxley, M. 530

Imberman, A. A. 672
Izumi, Y. 36

Jenkins, J. W. 316
Johnson, E. L. 267

Kaghazchi, T. 700
Kandiner, H. J. 208
Kaplan, M. A. 336
Kelly, H. 32
Keyes, M. H. 642
Klempner, D. 188
Klingman, G. C. 374
Koenig, M. E. D. 595
Kolonder, H. J. Nov.
IBC
Kreysa, F. J. 146
Krochta, J. M. 472

Landau, E. F. 547
Lantos, P. R. 184

Lavallee, C. 210
Lavallee, D. 210
Leenhouts, J. W. 408
Lefor, A. 783
Librizzi, W. 405
Liles, D. H. 129
Lilina, N. 520
Lundberg, R. D. 748

Manji, B. T. 472
Martin, D. 159
Matsuda, F. 306
McArthur, J. 144
McGowan, A. 205
McGrath, J. 67, 203,
333, 529, 653
McNicol, B. D. 316
Messman, H. C. 424,
753
Mills, G. A. 418
Mitchell, T. O. 680
Mizutani, Y. 36
Mohr, B. J. 616
Mok, P. P. 720
Moll, A. J. 551
Morrison, S. R. 570

Ogawa, J. M. 472
O'Keefe, A. E. 687
Oldfield, J. E. 290
Oliver, E. D. 551
Onoue, Y. 36
Orr, W. P. 28
Othmer, D. F. 601
Ouhadi, T. 192

Packer, L. 276
Parker, J. Oct. IBC
Perlman, D. 434
Petersen, H. J. S. 402
Petit, P. J. 496
Petrow, V. 563

Phillipp, B. 702
Pilato, L. A. 67, 203,
333, 529, 653
Platzer, N. 634
Plueddemann, E. P.
217
Poher, K. 164
"Prod, Z. A." 90
Puddington, I. 456

Reichle, W. T. 67,
203, 333, 529, 653
Reis, T. 366
Reymond, D. 664
Rickard, J. Sept. IBC
Robertson, S. D. 316
Robertus, R. J. 272
Romer, A. 10
Rosen, B. I. 690
Rowe, W. D. 477

Sargent, E. L. 464
Scharge, H. 153
Scheller, W. A. 616
Schleicher, H. 702
Segraves, D. W. 139
Serota, S. 248
Seymour, R. B. 507
Shane, R. S. 541, 657
Shapero, A. 70, 457
Shim, H. S. 40
Silbert, L. S. 248
Simmonds, W. H. C.
347
Skornia, T. A. 7
Small, H. 196
Sohrabi, M. 700
Sosa, J. M. 507
Spatz, D. D. 696
Spedale, D. R. 537
Spencer, E. Y. 576

Sperber, P. 225
Spitz, P. H. 295
Szekely, J. 207

Taylor, D. 548
Teyssie, P. 192
Theobald, D. W. 659
Thomas, A. H. 228
Tillman, D. A. 611
Totten, J. 84

Ukkelberg, H. G. 693
Umbreit, G. 101

Vanderbilt, B. M. 693
van Goolen, J. T. J.
309
Vegter, G. 108
Vickers, Z. 340
Viola, J. L., Jr. 459

Wagenknecht, W. 702
Walker, S. B. 742
Walton, J. 276
Watanabe, Y. 36
Weber, W. P. 690
Wei, J. 553
Weinberg, A. M. 330
Weisburger, J. H. 734
Weiner, P. H. 321
Welch, B. L. 282
Whitehurst, D. D. 680
Wiedemann, H. G. 381
Wittcoff, H. 754
Wright, W. L. 374

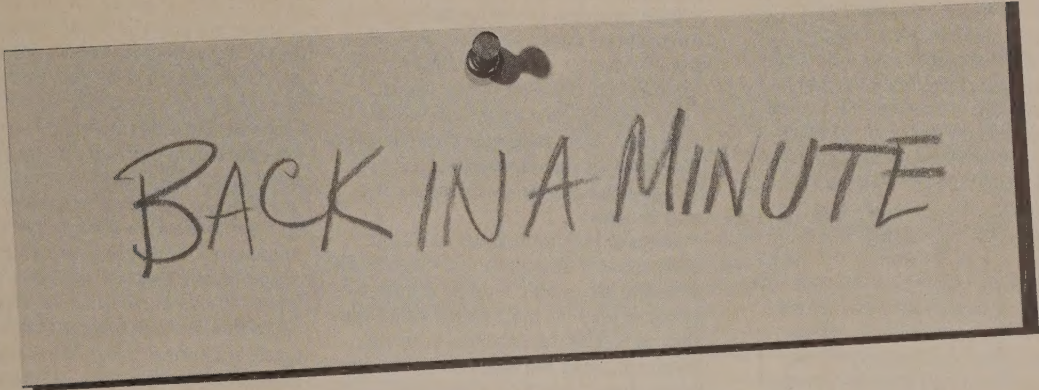
Yalof, S. 403

Zimmerman, M. 403

The Last Word

"Researchmanship", or how to get your PhD without actually working

Anonymous the Younger



BACK IN A MINUTE

In theory, getting a PhD involves a research project. If you are an ordinary type of chemist (as distinguished from a theoretical chemist, who is really not a chemist at all), this will involve laboratory work—eight full courses of it, according to the catalogue. Many plodding, unimaginative graduate students actually spend eight to twelve hours a day in the lab—working! But let us see how the true researchman "puts in his time."

It is a fallacy that the two or three years of thesis research are made up of eight- to twelve-hour days. It suffices to make it seem that way. This is called "putting in your time." The true researchman realizes that a chemical research laboratory is not a healthy place and that contact with noxious odors and corrosive chemicals is best taken in small doses. He realizes, from a consideration of the careers of the successful elder statesmen of chemistry, that there is little correlation between success and time spent in the laboratory. What follows are some hints about how to "put in your time" most effectively.

Keep proper hours

Make a point of coming to the laboratory a few minutes before your professor. This is especially important, if, as in the case of James J. Pudvin, the professor works in the same laboratory. If the professor is an early bird and arrives at 9:00

on the button every morning, be in your laboratory by 8:55. Don't bother with shaving, breakfast, etc.—just be there. By 9:00 you should be hard at work. At least make that impression. It need not be research by any means. For instance, Pudvin kept two Erlenmeyers ready all the time, filled with base and phenolphthalein indicator and always had a buret with haphazardly prepared HCl solution ready. When the professor arrived he would run his acid into several samples of base, always exclaiming "Aha, got you that time!" or the like when the indicator changed color. He once explained to his professor that the best analytical results were obtained early in the morning, when one was still fresh and clear-headed.

One can't do this every morning, so sometimes it would do well to reflux a bit of acetone, distill some solvent from a colored solution, or dump some HCl into a lead nitrate solution. As the $PbCl_2$ precipitated, Pudvin would exclaim triumphantly, "Wait till they read about this in JACS" or "Oh boy—another Communication!" An interesting variation was used by another student who did all of his work on the vacuum line. Each morning, the minute he came in, he would turn on the vacuum pump, and leave it chugging away all day. He rarely needed the pump, but he felt, with justification, that the sound of a busy vacuum pump was a

reassuring one to his professor. As a clincher he would set up a trap-to-trap distillation, feeling, again with justification, that a Dewar filled with liquid nitrogen was very suggestive of research in progress. The sample of ether that was transferred back and forth was, without doubt, the most well-travelled sample of ether in existence.

By 9:15 the professor usually is deeply immersed in the morning's mail, so it's safe to leave. It would do well to make an appropriate remark on leaving, such as "I hope I can get at the A60 now" or "I hope last year's JACS is back from the bindery." Thus having made your early morning presence known and having clearly stated your intention of working, it is safe to return to the sack and catch a few more hours of sleep after reading the paper and having a hearty breakfast.

It would do well to come back after lunch, to ask the professor some trivial question, as for instance, "Have you read that article by Bullovsky in the latest Tetrahedron Letters?" The professor, being a busy man, will, of course, not yet have laid eyes on the journal. Questions such as these after lunch have several things to recommend them:

- you will have advertised your continued presence in the laboratory;
- you will have made an impression on the professor—he will think that you

are a real go-getter, always up on the latest literature; and

- he will feel a trifle ashamed that he's not quite up to date in his field.

Having shown that you're still around, you can safely take in an afternoon movie.

Condition of the laboratory

Closely allied to the "putting in your time" gambit is the condition of the laboratory. Obviously, a neat and orderly laboratory with clean lab benches and spotless equipment would arouse a professor's suspicions. The laboratory must look "worked in," or better yet, "lived in." Pudvin usually kept his laboratory benches littered to make the lab look as if he was madly researching away. On his desk would be sheets of calculations. However, when putting equipment out on the benches, use discretion. The equipment should be rotated periodically. The same flask with the same red solution standing in the same spot for three weeks would do much to cancel any good impression that otherwise might have been made. The morning "work period" (9:00–9:15) can be used for equipment rotation. Pudvin usually kept some well-formed crystals under a watch glass on the bench and when the professor made his rounds would remark that "they have an interesting NMR spectrum but I'm still waiting for the analysis." Pudvin was quite partial to parachlorobenzene, azoxybenzene, and ferrocene. Here again, rotation is essential to the success of this gambit. To make the laboratory look "lived in" Pudvin equipped the immediate vicinity of his desk with magazines, selected light fiction, hot plate and coffee pot, alarm clock, a clean shirt and tie; furthermore, he had all of his mail delivered to the laboratory. All this created the inescapable impression that the lab, not his room, was his real base of operations; that his moments of relaxation occurred in the lab, not elsewhere.

Night work

All professors expect a student to have an all-night session in the lab once in a while. Perhaps they feel that if they as students did so, the present generation should suffer in a like manner. Do not disappoint your professor! Pudvin "worked nights" at least twice a month, and his simulation of suffering was so successful that often his professor told him to "go home and get some sleep before you have an accident." Pudvin's approach, which is by no means the only one to take, was as follows.

In the afternoon Pudvin would announce his intention "to make a night of

it." He would sign up for the preparative GLC unit for the hours of 8:00 p.m. to 5:00 a.m. ("How else can I get 25 g of starting material?"), and would decline all invitations to go to the movies, play bridge or pool, etc., preferably when the professor was within hearing distance. When everyone was getting ready to go to supper, the professor included, Pudvin was seen carrying flasks, GLC receivers, syringes, coffee pot, radio and a green eyeshade to the GLC room. Next morning at 9:00 when the professor arrived, Pudvin would be found, haggard, pale, noticeably thinner, proudly displaying a 50 mL flask half full of colorless liquid. "100% pure" he'd cheerfully tell the professor. After such concentrated devotion to duty it was not unexpected that Pudvin was not seen in the lab for the next two days.

Actually Pudvin's nightly exertions were spent in strenuous, but pleasurable activities not related to chemistry in the remotest way. At 8:30 the previous evening he had left his laboratory, being careful to leave the lights on and a sign on the door ("BACK IN A MINUTE"). The radio played all night, and the coffee pot remained on "reheat" until Pudvin's return at 8:00 a.m. The flask which he so proudly displayed was filled with 100% pure ethyl acetate.

Choosing a thesis problem

The choice of a thesis problem is second only to the choice of the research professor in terms of its impact on a graduate student's life. Having picked your professor, it is wise not to commit yourself to a thesis topic right away. Get to know your professor a bit better through discussions with the professor's older students. Find out what problems they are working on, and even more important, on what problems they started out their research. The professor's "Pet Problems"—which really intrigue him—are probably those which no one has been able to make work. These are to be avoided: pious words to the contrary, a PhD degree is awarded for completion of a *successful* project.

Pudvin's professor in their first discussion tried to sell him a Pet Problem:

Professor: "Well, I had a little idea the other day that the hydrogenation of boron carbide, if carried out right, should give tetramethyldiborane. That would really make industry look up—we might end up millionaires, to say nothing of the hot papers we'd write . . ."

Pudvin: (His face showing a mixture of boyish enthusiasm and mournful regret): "Gosh, sir, that sounds real great—it's bound to work. It's really too bad I can't

take it on, but in my undergraduate thesis I found that organoboron compounds make me break out in purple blotches."

By way of explanation, Pudvin had found out in his "explorations" in the professor's research group that the professor really had this idea nine years ago and that seven students had already failed at it. Note that Pudvin's excuse allows for no armtwisting by the professor.

Join a going concern; that is, pick a problem that is closely related to work already in progress in the professor's group. If you do this, the chances are good that you will have minimized both time and effort. There will always be supplies of starting materials around in the research group that can be borrowed, shared, siphoned away in small doses, etc. Also, all required equipment will be on hand in drawers and on drying racks of the more senior graduate students and expert consultants will be close by at all times—those older students who have come to know more about that particular patch of chemistry than the professor himself. If you do not join a "going concern," you will in truth be a pioneer, entering into unexplored country, the "opening up" of which will require you to carry in your own supplies, and you will tread unmarked paths without a reliable guide. Translated into laboratory terms: you will have to prepare all of your own starting materials and will have only your professor to go to for advice.

Perhaps the best type of problem within this framework is a kinetic study. Here reasonably small quantities of starting materials are required, so that you need never dirty your hands at their preparation. Also, in contrast to a preparative problem, a kinetic study always gets results, i.e., a sackful of numbers, which need not always be meaningful. But that is of no concern to the researchman. Fred Melba, a friend of Pudvin's picked a kinetic problem and worked furiously gathering data during his first summer of research while his professor was lecturing at an NSF Summer Institute. He then fed out all these data in small portions, first in raw form, then in final, refined form, to his professor during the next three years, all the while making his lab look "worked in" and "making nights of it." His professor was at first quite flattered by Fred's pleas for seasoned advice, but after a while got mighty tired of them and soon began avoiding Fred whenever possible. Fred's last two years of "putting in his time" were pleasant indeed.

We are grateful to Alan Lefor, Hall-Atwater Lab., Middletown, Conn., for this one.

Author's guide

CHEMTECH's manuscript selection criteria

Most CHEMTECH manuscripts are still solicited, though this is not by design. We welcome voluntary submissions of broad appeal to mission-oriented technologists. The main criterion of selection is a positive answer to either of two questions (or, preferably, both):

- Will the paper help a lot of technologists do their jobs better, more creatively, more efficiently and, in short, help bring science rapidly and sensitively into the social sphere?
- Will this paper spark and help satisfy the innate curiosity of chemistry-oriented professionals and lead them readily into unanticipated areas of exploration?

It is thus apparent that full technical papers, though valued most, are not the only kinds sought. It should also be apparent that prior publication is not a block to acceptance by CHEMTECH. The crucial point is whether the prior report is readily accessible to a polydisciplinary group who often are unaware that a particular piece of work could be valuable beyond its primary target.

We welcome reader recommendations of areas CHEMTECH should cover and/or authors to contact. *If you've come across work that has stimulated your thinking, please tell us about it.*

CHEMTECH's style

We have no fixed style criteria beyond a design to publish manuscripts that are easily read. Because we are now inundated with high-quality, timely manuscripts, we ask authors to be as terse as possible, consistent with our mission:

- To generate an awareness and interest but not necessarily expertise. Given the first two, and a good bibliography, expertise will follow.

As a style guide we recommend Strunk and White's "Elements of Style", Macmillan, New York, N.Y., 1959, 71 pp, paper \$1.65. We also recommend use of a tape recorder for generating the first draft and a determined effort to eliminate jargon and verbiage that do not strengthen the argument. Deleting words such as *very*, *really*, and often *the* and *and* adds surprisingly to crispness. "In other words" often signals a redundant paragraph; inclusion of authors' names in the text, though polite, seldom helps the reader. Active, crisp, first-person case history reportage does. So do charts, graphs, flow sheet diagrams, and photographs (see below).

Reading through an issue of CHEMTECH before setting out to write often helps authors set tone and level of their manuscripts. Rendering complex concepts simple is difficult but, oh, so rewarding.

Literature references should be numbered and listed in order of reference in text. They should be listed by author, patentee, or equivalent. In the text, just the number should be used or the name should be followed by the number. "Anonymous" is not acceptable for authorship. If the author is unknown, list the reference by company, agency, or journal source. Do not list references as "in press" unless they have been formally accepted for publication. Give complete information, using abbreviations for titles of periodicals as in the Chemical Abstracts Service Source Index, 1975.

For periodical references to be considered complete, they must contain authors' surnames with initials, journal source, volume

number, issue number (if any), the first and last page numbers of the article, and the year of issue. State if a reference is in a language other than English.

Graphics

In general, graphs are preferable to tables if precise data are not required. When tables are submitted, however, they should be numbered consecutively in Arabic numeral style in order of reference in the text. Double space with wide margins, and prepare tables in a consistent form, each on a separate 8½ × 11 sized sheet.

Original drawings or sharp glossy prints of graphs, charts, and diagrams are acceptable. All lines, lettering, and numbering should be sharp and unbroken. If coordinate paper is used, use blue cross-hatch lines as no other color will "screen out".

Typed lettering does not reproduce well; use black india ink and a lettering set for all lettering, numbers, and symbols. On 8 × 10 in. copy, lettering should be at least ½ in. high and 0.017 in. thick—for example, with a Leroy lettering set, use template 120C and pen No. 0. Lettering on copy of other sizes should be in proportion. Label ordinates and abscissas of graphs along the axes and outside the graph proper. Do not use pressed wax lettering as it will rub off easily in handling.

Photographs should be supplied in glossy print form, as large as possible, but preferably within the frame of 8 × 10 in. Sharp contrasts are essential.

Number all illustrations consecutively by using Arabic numerals in the order of reference in the text. On a separate sheet, include a typed list of captions and legends for all illustrations.

If drawings are mailed under separate cover, identify by name of author and title of manuscript. Advise editor if drawings or photographs should be returned to the author.

Form

Manuscripts should be typed double spaced. About 20 such pages is a good maximum length. Longer manuscripts can be serialized. Shorter ones are welcome: 3½ typed pages make a single printed page Department such as "Out in the Plant" or "The Last Word".

Three copies of the manuscript are preferred. A sharp, informal "head shot" of the author is also requested as is an informal biographical sketch. A signed copyright transfer form is required on acceptance.

Send manuscripts by certified mail with a **return receipt requested** form. (It will be your acknowledgment of receipt.) Address:

Dr. B. J. Luberoft
CHEMTECH
48 Maple St.
Summit, N.J. 07901

Acceptance decisions are normally made within six weeks of receipt. Faster action can be arranged in extreme circumstances. Delays happen too.

Authors receive edited galley proofs for approval.

On publication, several "thank you" copies of the full issue are sent to authors. A reprint order form is sent under separate cover after publication.

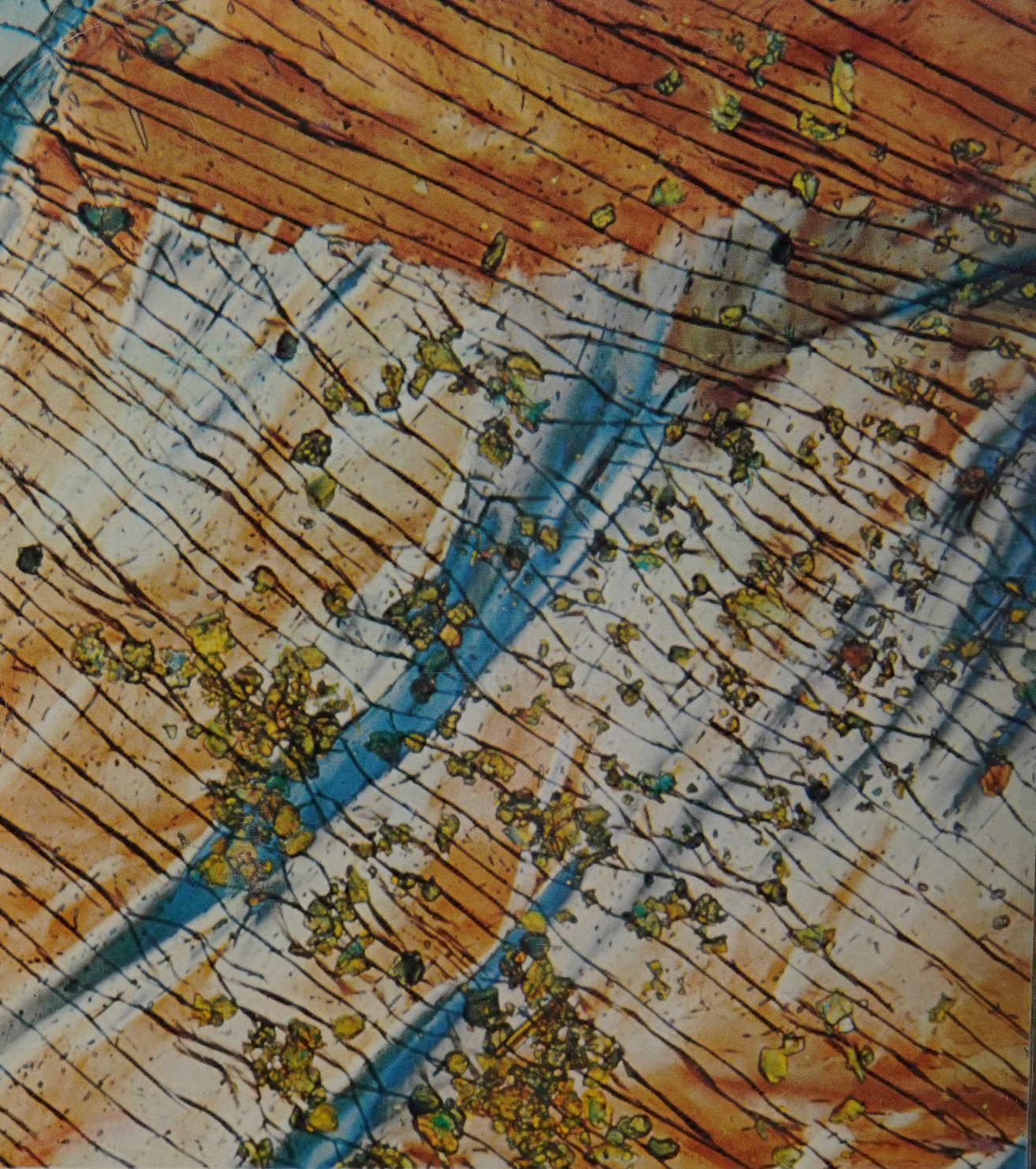
CHEMTECH levies no page charge.

1978 Subscription Rates

	U.S.	Other Nations
ACS Members (12 mos.)	\$13.00	\$17.00
Nonmember personal use only (12 mos.)	\$20.00	\$24.00
Institutions, Companies, Libraries (12 mos.)	\$65.00	\$69.00
Student Member	\$6.50	\$10.50

Subscriptions and payment may be sent to

Controller, ACS, 1155 16th St., N.W., Washington, D.C. 20036



Photomicrograph by John Delly, McCrone Research Institute

Take a closer look at EASTMAN Organic Chemicals.

(protein, polypeptide, and other reagents)

This beehive of interacting crystals is a photomicrograph (enlarged 378X) of EASTMAN Chemical 192, p-Nitrophenol. It's one of our many products for protein and polypeptide synthesis and analysis, including: amino acids; coupling-, deblocking-, protein-modifying-, sequenation-, visualization-, and gas-liquid

chromatography reagents; polymeric supports; and thin-layer chromatography products.

Look into them—or into our many other chemicals for electrophoresis; liquid scintillation counting; and dyes, stains, and indicators. All available only through nearby dealers.

For details, quotes, and a free poster of this photomicrograph, see your dealer. (For larger than lab quantities, call (716) 458-4080. Eastman Organic Chemicals, Eastman Kodak Company, Rochester, N.Y. 14650.)



Worth a close look.